ADDRESS

by

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to

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Thank you for those kind words Your Excellency, Mr. Minister, Associates in interest in space. I suppose I am, as you point out, somewhat of an expert on Australian-American relations - the daily domestic problems to be resolved and four half American and half Australian children remind me continuously of the international aspects of some operations.

This morning I welcome this opportunity to stand before you and tell you something about the future of the American space programme. This is a part of a series of visits which I have been making to the advanced nations in Europe and in the Pacific to highlight the opportunities which we see for increasing international co-operation in the 1970s. My boss, President Nixon, has asked me to devote a substantial portion of my time to finding new ways of increasing international participation, international co-operation, in the area of space. I can assure you that it will be United States policy to welcome any proposals which you may make for Australian initiatives to find ways of bringing the benefits of space to people right down here on earth and to work with us to advance this as rapidly as possible. I made similar proposals to the governments in Bonn, Paris, London and Ottawa and within the next week I will be making similar proposals to the government in Tokyo. We have also been speaking to the European Launcher Development Organisation, the European Space Research Organisation, and through them to the nations in Europe which also are interested in space. In addition we have been talking to the less developed nations with which we co-operate in various bilateral programmes, asking each of these people to consider the decades that open before us in the 1970s and the 1980s, to review the very substantial progress that has been made in international co-operation in space in the 1960s and to regard this more as the foundation upon which we should build new institutions, new programmes, new inter-relationships in the coming decades as we face a very rapidly changing period in space.

This morning I would like to start my remarks by pointing out that in the 1970s we are indeed, in our opinion, facing a very rapidly changing technological situation. Many of the activities which we carry out today in space which seem to have come so far in the last decade are going to change still more radically in the 1970s. I think we should all understand that, as we consider the things which it will be possible to do in space, when we consider the economics of the various activities which might be undertken we should look to the future and ask ourselves, in the context of the technological capabilities of the late 1970s, what it will make sense to do rather than look backward to the rather crude systems which we have today.

This is an excellent morning to be having this discussion with you because today actually marks the tenth anniversary of the Australian-American agreements which in my view have been extremely fruitful. Australia and America

lie in opposite positions in the globe in such a way that our two geographic positions make it extremely important that we find ways to work together in the space age. Anything which we launch on a reasonable trajectory out of our Cape Kennedy and our Western Test Range Launch Platforms will wind up within a 45-minute period in the skies above Australia, so that for that reason alone it has made a great deal of sense to work together from the standpoint of the United States.

I would certainly hope that you have found beneficial to your own interests the activities which have been carried out here, some of which I visited yesterday. We have invested in the programme to date some $US74m in our tracking stations here in Australia. Yesterday at Tidbinbilla I saw the start of the construction of the new installation which will represent an additional investment of some $US17m for a new Deep Space tracking activity. I think that this is simply the beginning and this morning I would like to speak more broadly upon our programmes and the need for your consideration and your questioning how this may interact with Australia's own interests.

As we look to the 1970s in America we regard the programme which we will be carrying out as a major and dramatic change from the philosophy and the programmes of the 1960s. You all recall the start of the American space programme tracing back to the International Geophysical Year, in which it was proposed to launch earth satellites as part of the broad geophysical investigations of the earth. You will also recall the great surprise when the Soviets (as they had previously announced, incidentally) suddenly put their satellite up in advance of that which we had planned. It was followed by a series of difficulties with our own launch vehicle, with our own development activities culminated by the launch, some months after the Soviet Sputnik, of the first American Explorer satellite - a very small 30 lb object about the size of a little grapefruit - which we put into orbit to initiate our own space programme.

In the 11 years or so since that event we have certainly come a long way. Instead of 30 lbs in earth orbit it is now of course routine matter to put 100 tons or so into earth orbit bound thence to the moon. We have been able to reduce to routine sufficiently precise navigation schemes so that we can with pinpoint accuracy land at a spot on the moon with nothing but geographical co-ordinates; not homing in on any radar beacon we can precisely land at a pre-selected spot alongside a previous space craft. The important thing is not the fact that a rather dramatic television programme was able to record these events and bring them to a large part of the earth's population as a spectactular exploration; the important thing I think is rather the development of capability and the fact that in order to do this we are forced to push ahead almost every field of science and technology - material sciences, medical sciences, the art of navigation, propulsion, structures, materials - almost everything that modern technology makes possible had to be extended even further in order to carry out the first moon landing. And that was the deliberate choice

made back in the early 1960s, by setting before us the objective of a lunar landing to which we would bring the capability for very broad space operations.

I think it was a wise decision; I think it is standing the test of time; I think that it indeed focussed our efforts and gave us the ability to do the things which open now before us in the 1970s. But as we look at the 1970s we do not plan any similar large major single purpose activity. Rather the programme we are discussing this morning is envisioned as a broad based programme - a balanced programme - emphasising continuing exploration on the one hand and also emphasising the down to earth practical benefits to realise some of the return on the investments which we have made in space and to realise these in a very substantial way. I think that this aspect of the programme in particular is one which I commend to your special attention - the opportunities for down-to-earth applications are very broad. They are so broad in fact that they lie beyond the ability of the United States to capitalise on.

One of the things which we would welcome from you gentlemen is your expression of those areas in which Australia would like to join with us in introducing the practice of things which will help the development of your own nation and at the same time things, which because you are doing them, will help us.

We also however will continue to pursue a very aggressive research programme in space science. The developments which have come from the field of radio astronomy, in which Australia has played such a leading role within the last few years, indicate a great renaissance, a great springing forward for knowledge of the universe which certainly has some very great promise for technological application. For the moment this is almost entirely concerned with fundamental understanding of the universe around us, via our orbiting astronomical observatories which of course dump a great deal of information through the tracking station here at Orroral, where we were visiting yesterday. This kind of thing is also supplementing the information which we are getting from the radio astronomy ground based telescope, teaching us a great deal that is very new about the nature of the universe.

We would hope that on a suitable scale there would also be interest on the part of Australian scientists in joining with us in this exploration of the tremendous new forces that we are observing at work in the universe - the giant pulsars, the quasars, things which we are finding in the ultra violet parts of the spectrum by having astronomical facilities outside the earth's atmosphere and orbit which are teaching us a great deal which is new about the size, the structure, the age of the universe and in fact radically altering our views of the universe in its progress. We also will forge ahead in the ability to carry out more diverse and more advanced operations in space. We are going to put a fair amount of our investment into bringing into being new kinds of operational capabilities.

Well this, then, is the kind of programme that we face. A programme which will balance its investment in science, technology and have an application in new exploration.

One other factor which I should mention - Ambassador Rice mentioned the space shuttle system. We are seeing a new drawing together of space technology and aeronautics technology in the 1970s. These two technologies took somewhat different directions during the 1960s; we see them drawing back together again as we move to an era when we will be combining our very advanced aeronautical technology with our advanced space technology to produce hybrid systems. The space shuttle will be the first of these.

One of the very important activities which you will be pushing ahead with in the 1970s is the increasing application of nuclear power, nuclear energy to meet the demands of the space age. As you all know and as we saw yesterday at the tracking station, we have today a long life, rather small, nuclear power station on the moon which is powering the instrumentation of our Apollo lunar surface experiments and we hope will be continuing to power them for perhaps many months. We are also harnessing the power of the atom for the propulsion of rocket ships. We have at our Nevada test sites in the western part of the United States at remote locations a prototype ground based nuclear rocket which we have operated now at full power for many minutes - we have started it and stopped it many times, we have throttled it back, we have carried out many of the activities on the ground which will be required for nuclear rocket propulsion before the end of the decade of the 1970s. I mention this because I think it is important that we look to the future - that as we look at the programmes which we will be able to carry out in space, we do concentrate on those new capabilities which we will have and ask outselves the question: What are the things that we should be doing with these new technologies? - rather than look back to the rather crude chemical rockets of the 1960s which have served us very well but which are nearing now the end of their technological obsolescence period.

The nuclear rocket is a fundamental step forward because of what to you rocket experts is known as the specific impulse of a rocket engine. Very simply that is similar to the miles per gallon you might get in an automobile. The specific impulse is the amount of thrust that you get per pound of fuel. In the nuclear rocket we have already attained in our ground based prototypes twice the maximum that we can ever hope to get from chemical rockets. This is very important for such things, for example, as the ability to put very large complex objects into the geostationary orbits - not only to put them into geostationary orbits (this of course is the place where communications, weather observation, navigation and many different kinds of economical activities will be,) but we can also go up and bring them back to lower earth orbit, bring

them back to earth for reworking and re-emplacement after they have been resupplied, repaired and new systems put into them. We can take them back up again into geostationary orbit. The point is that we can do this readily and at a modest cost.

I think you can see that with this kind of capability coming intc being in the 1970s this will radically change our entire design approach to satellites. It will certainly change the economics of satellites and make it far less expensive to use these kinds of systems. When you consider such things as direct broadcast satellites I think you can see how important it will be to utilise these new capabilities.

We are approaching a period when in our view it is increasingly important to think in terms of global systems. I would like to mention one other area of development which will be of concern to all of you and this is the marriage which is now taking place between satellite communication systems on the one hand and the giant computer networks on the other hand. Increasingly we are thinking in terms of global systems, for example the weather satellite systems, gathering from earth orbit information and data which will be fed then through satellite communication systems into the information banks of which giant computers of the next generation and the generation beyond will constitute the fundamental heart. By developing new mathematical modelling techniques which will take into account increasingly the many different atmospheric processes that go on to generate the world's weather we believe it will be possible to bring a whole new dimension of weather forecasting, weather research, and even eventually, perhaps - the dream of many years - of weather control. It will be possible in some cases to bring this about through these global satellite information-gathering, information-transmission and then computer-modelling systems.

Inherently the kind of systems which we will be bringing about are global. There is no such thing as a satellite system which can home in on a small part of the world like the United States or Australia. That is one of the reasons why it is so important that we do develop these international institutional frameworks to make it possible for us to work together and to get the maximum benefit for all of our peoples from these new global systems.

In addition to the weather systems, you are all familiar with the advances which have been made in the communication satellites. Again I would emphasise that communication satellites in their development are somewhere today - to use an analogy with aircraft - perhaps of the era of Sopwith Camels, the Spads, or the tri-motor Fokkers of World War I. We have gone beyond the Wright Brothers phase but we are still back at a very crude phase compared with what we already have on the laboratory benches looking to the future. Communication satellites are certainly going to move away from the simple voice circuits, the simple television point to point

communication that we have today and move to a far different capability, a far different means of carrying out communication functions in the future. Again, ability to operate larger, more complex systems at lower cost, the ability to revisit, to refurbish, to update satellites, is one of the things that is going to bring this about. Also the ability to provide greater amounts of power to activities in orbit will be another factor here.

Today point to point satellite communication is a reality, but really this is not the way to use space age communications. What we have really done with most of the satellite systems today is simply to put a cable in the sky; we go from a very elaborate ground station here, via the satellite to another very elaborate ground station there, and these two might just as well be connected with a cable. As we look to the future we see the possibility of moving from a multi-point ground system to satellites, from one satellite to another, back to other points on the earth and performing some of the switching functions in orbit so that for the first time you can begin to think in terms of a satellite system which is not point to point communication but which will pick up communication from a large variety of places, take the communication where it belongs and then bring it down directly to a pre-selected area.

In our F&G Application Technology Satellites we will be carrying the first optical laser communication equipment up for communication from one point in orbit to another point in orbit, which we believe will be one of the things which will make this type of new communications a practical reality. Some of the experiments which you have been doing with your Cooby Creek activities are already beginning to go from the single ground station to the satellite to cover multiple points across the continent of Australia.

In addition in our Application Technology Satellite F series we have an agreement with the Government of India in which we will be turning over to the Indians a period of time of operation of this satellite with a beam directed capable of carrying television signals down to the entire subcontinent of India. The Indian Government has undertaken to provide the ground station for transmission and the multiple receivers in perhaps as many as 5,000 villages across India which will directly receive the television signal from the satellite - the first experiment in broadcast of television signals directly from orbit. This is an experiment which I think also may have substantial implications for Australia particularly for the possibility of television signals in the Australian outback; it is an experiment in which the Indian Government has undertaken to do all of the ground work.

Our participation in this is entirely restricted to making available time of the satellite, moving the satellite to a position over the Indian Ocean, directing the antenna

beam down to cover the subcontinent and then all of the programme material is under the control of the Indian Government. In this connection they have been carrying out a series of tests using ground based television broadcasts of the kind of programme material which may be of most use to the Indians. The kind of thing that they are doing here is primarily educational. It is aimed at getting, for example, agricultural information to the Indian farmer with a television programme, which does not depend of course on the literacy on the part of the person participating at the village level. They are trying to make the programme content reflect on a day by day basis the interests and needs of the viewer. For example in the springtime it could be concerned with the preparation of soil, with the planting of the seeds, in the fall with the harvest and with the preservation of the crops; in between it would have such material as population control, and things of interest to the Indian Government in trying to weld together a national feeling on the part of the villagers and hopefully trying to prevent some of the great inrush of the villagers into the crowded slums of the cities.

Now whether or not this will be successful remains to be seen but the way in which the Indian Government is approaching this is very encouraging to us. They are actually now carrying out some of these test broadcasts. They have identified a number of villages which are to all intents and purposes identical; They have put receivers in half of these villages and they are now studying the difference between the villages which have receivers versus those which do not have receivers to try to see the effect of various kinds of programmes, various kinds of programme content.

I think this is an experiment which we are delighted to be participating in because we believe this may have substantial implications for other developing nations. But I think those of you in this room are probably conscious of the fact also that the ability to broadcast television signals from orbit really transcends simply the interest which the Indian Government has in this, it is going to bring about a whole new capability to the world, one which is going to take great deal of thought on all our parts to understand how it is to be controlled and managed and utilised. It's a whole new technological capability which is going to put demands on our political systems, I am sure, to understand just how this thing is going to be utilised. And yet this is something which is rapidly coming upon us.

Another practical area which I would like to mention is the area of the air and sea navigation satellites. We are undertaking discussions now with the European Space Research Organisation for a North Atlantic air traffic control satellite which in the process of providing air traffic control will also have sufficient capability for the North Atlantic shipping routes. This will be a satellite which, as we look at the economics of it, will be economically highly self-supporting - in fact the

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savings that can be made on the air traffic lanes of the North Atlantic with such a satellite will far outweigh the costs of putting such a satellite into operation and keeping it operating.

The important thing to realise here is that as we study this North Atlantic traffic control problem we get immediately involved in the question of domestic American air traffic control because the days when jets had to fly the Atlantic and then land on the edge of the North American continent are long since over. We now regularly fly to the interior, to Detroit, to Chicago, to St. Louis, Washington and increasingly air traffic control is changing from an international and domestic system really to essentially what will amount to a global system. I think it is very important that we do not bring into being a large number of chaotic systems which cann't interpenetrate with each other and which will make it impossible for the operators like Qantas, for example, which fly aircraft right around the world, to put in one piece of equipment that will be good everywhere. So we have a real job to do again in the institutional area trying to take this rapidly moving technology of space and particularly in air traffic control and see to it that the wisest decisions are made to bring these benefits to all people.

We would particularly welcome the thoughts of Australia in our North Atlantic air traffic control system not simply because Qantas also flies that route - and incidentally provides a very fine competitive service from New York to London - but also because these same Qantas aircraft will be passing over the Pacific and it's very important that the Pacific service and the Atlantic service come out with the best overall system.

Passing on then from air traffic control to a brand new area which I know is of considerable interest to you and on which we would like very much to have your thoughts, I would like to discuss briefly the things that lie ahead of us in what we call the earth resources technology satellite programme. This is rather unflatteringly referred to as ERTS - and we're trying to get away from ERTS and think of a better name. Fundamentally what we're concerned with here is the application of satellite surveillance capabilities, looking down at the earth from orbit to assess many of the activities of economic interest on the surface of the earth, to monitor these and to utilise this kind of capability to find new ways of increasing our knowledge of the earth's resources and our knowledge of how these resources can best be utilised by mankind. A great deal of progress has been and is being made in this area and I would like to interject a cautionary note and say this is still an area whose future potential remains to be really thoroughly understood. It's an exploratory experimental capability at the moment.

What we are finding is that in our Apollo and Gemini flights, and in other experiments we have been able to carry out with high flying aircraft, it is possible using modern photographic techniques to characterise with great precision the kind of processes going on on the surface of the earth below. This is true in a remarkably large number of fields. I could mention forestry and fisheries and agriculture; I could mention oceanography; I could mention geological resources - many different areas in which we can look at the earth (particularly through monochromatic sensors which take one very narrow spectrum of light of the electromagnetic spectrum) and then compare this with an earth observation made simultaneously with a number of other very narrow split parts of the light spectrum. What we find when we process pictures taken in this way and when we process information from different sensors is that we can detect very minute changes in activities on the surface of the earth. For example, to mention the Indian Government again, there is a problem at the moment with a new kind of palm tree infestation which is bothering the Indian Agricultural Ministry, and we have found that these multi-spectral sensors which we can fly in our aircraft at the moment, and which will be suitable for flight from orbit, have a remarkable ability to discriminate between those trees which are affected with this blight and those trees which are healthy and unaffected. It is also possible to characterise the kind of agricultural stress which an agricultural field is undergoing with these kinds of sensors. We can detect the health of the crops; we can detect where an unhealthy condition has been observed, whether or not it is due to lack of moisture; whether it is due to a lack of adequate nutrients and fertiliser; whether it is due to some sort of plant disease which is beginning to spread into this area. We have had similar success in forestry. We have been able to find various kinds of stresses in forests.

In the area of fisheries, some of the sensors which we have flown have been used by the Government of Iceland in a co-operative programme to locate schools of fish which had rather mysteriously vanished. We happened to have our earth resource sensor aircraft flying around the island at the time that the fisheries were in difficulty, and with some of the infra-red sensors which are able to map very small differences in the temperature of the surface of the ocean we discovered that the normal interface between the rather cold water of the Arctic and the warmer water, in which the fisheries take place, had shifted very radically out to the westward and that the fish apparently normally had been feeding very close to this interface and they had followed this interface between two water temperatures - two different currents - outward as it shifted; fishermen who had gone to their normal fishing places and had not encountered the fish, were not aware of this radical change in the local water currents and temperatures.

I mention this because in the area of fisheries I think there is a great deal that can be done from orbit, because we do automatically cover the entire oceans of the world every time a satellite pass is made.

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With the kinds of sensors we are carrying for our agriculture and mineral resource and otherlland base interests we also are finding we can learn a good deal about the world's oceans. You all are aware of the fact that some of the richest fisheries in the world take place where the deep ocean high mineral content water wells up to the surface. Again we have been able to detect this with high flying satellites. Even on one occasion we detected a patch of ocean off one of the Hawaiian islands which, when we sent ships out to investigate what this mysterious phenomenon we kept picking up with the satellite passes might be, was discovered to be a great intrusion of fresh water which was apparently coming down and percolating through the volcanic soil of the islands and then welling up deep out at sea - a sort of an artesian fresh water activity.

Well, whether such things have any practical application remains for the future, but we are convinced that this is something we certainly should be pursuing and if there is interest in the problems of this part of the world, this might very well provide a useful place for us to work together. We have had some discussions with the Government here, some years ago, about the ways we could best work together in this earth resource satellite programme. At that time, some interests was expressed in bringing in one of our earth resource aircraft. Unfortunately the aircraft we are flying now really are not sufficiently long legged to conveniently make a trip down to Australia. Our view of the most promising way to proceed here would perhaps be to bring some of your people up to fly with us in these aircraft out at Houston, to look over what we are doing, and then perhaps on the basis of more intimate knowledge of our programme see just what implications this may have for some joint work between us.

One other area that the earth resource programme is aimed at is the general field of mineral exploration. This is of interest because in spite of the fact that we feel we know the surface of the earth very well, there are many very largely unexplored territories in Australia and the United States. In spite of the advanced state of our countries we are constantly coming across new, unfamiliar things. Partly this is because the things we look for tend to change. The early prospectors that went through much of Australia looking for gold did a pretty good job I expect, but today's economy demands many exotic new things, and it is certainly fair to say that there is a great deal of exploration for minerals to be done. We feel that the new satellite techniques can bring a great deal of new power to this. Many of the mineral surfaces on the surface of the earth are, of course, associated with different plant growth, as the seasons change it is possible to correlate the kinds of vegetation with the kinds of underlying minerals. This is one area in which we think the satellites may be effective. also in direct observation of geologic features.

We have been able to detect from orbit very vast features which had escaped detection from close down, even with high flying aircraft, because of their very size. There are such things as gravitational anomalies which we can measure from orbit which really are not very easy to detect on the surface of the earth. In fact, I must confess that we are in a somewhat unhappy situation at the moment because, through our lunar orbital programme, we think we understand more about the gravitational anomalies that exist on the moon than we do about those right here on earth. I am sure that there is some interesting geological and mineral information associated with these gravitational anomalies that we still have to discover but which I think as we move ahead will have some long-term practical applications.

In the field of Arctic and Antarctic development, I am sure the earth resources satellites which will pass over these regions on every pass are going to give us some new capabilities. We were discussing just this morning the fact that the cloud cover and meteorological information, which comes down from satellites has been very useful in the Antarctic prints because we can look at ice packs and we can look at cloud covers. I think the earth resources satellites are also going tobring a new dimension to our understanding of the oceans, the land mass and the ice masses of the Arctic and Antarctic regions.

Now let me just say a brief word about the new technology that I mentioned to you - the space shuttle activity. Let me hasten to say that I am not standing before you with any idea that Australian astronauts should buy a space shuttle and fly tomorrow. We are not interested in this as a Buck Rogers technique, but we are interested in this new space shuttle system. Our principal interest is the fact that this promises to reduce by a factor of 10 the costs of operating in space. The cost of putting a pound of material into orbit today and leaving it there is about $500 for about 1 lb of payload. This $500 per lb is our cheapest cost - most of them are substantially more expensive than that, using existing rocket capabilities. The Saturn 5, the largest rocket that we have, can get down to about $500 a lb providing that you use the entire payload capability. We would like to reduce this to about $50 a lb before the end of the 1970s. So in order to do this we have got to go away from the idea that to fly to space, one should throw away a number of rocket stages. Looking at the advances that we made in our lunar programme in space craft propulsion, particularly in the high energy hydrogen-oxygen engines which power the second and third stages of the Saturn 5 rocket, it is clear to us that we have chemical rocket engines today of sufficiently high specific impulse (which you will recall is the amount of thrust you can get from a pound of fuel) in the best rockets we have tested in the laboratory benches to make it possible to develop a two-stage to orbit rocket plane.

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To give you a picture that you can carry in your minds of what this development will entail, this is a project on which we would like to see the first flight about 1976 or 1977. It will look like one of these giant new 747 intercontinental jets, but instead of being on the airstrip horizontally for a takeoff it will take off vertically, so it will be racked up sitting on its tail. Instead of having jet engines slung under the wings it will have rocket engines, of the type that power our Saturn 5 rockets, clustered in the tail. Then mounted on the nose of this 747 first stage, which we call the booster stage, we will have the second stage which we call the orbiter, and this will be a space craft which will be about the size, weight and appearance of a big transcontinental Boeing 707. This will have wings, and the system will take off vertically with the 747 size stage taking it up outside the atmosphere and giving it a velocity of about 7,000 miles per hour. At that point the fuel in the first stage, or most of it, will be expended; the second stage will disconnect, light its own engines which will give it an additional 10,000 miles an hour incremental velocity raising the velocity of the orbiter then up to 17,000 miles an hour, which is orbital velocity, and it will remain then in orbit indefinitely. The first stage would fly back and land horizontally like an airliner and be ready to be refueled, another stage put on top and repeat the process. The orbiter can remain in orbit for 1 week or 2 weeks and would be capable of recovering a payload or placing a payload in orbit and would be capable of bringing into its cargo bay an object which was already in space and refurbishing it, reworking it, putting new supplies aboard, doing whatever has to be done and then either putting it back into orbit or bringing it back down to the earth. The capacity which we are planning for this orbiter stage is to be able to take a cargo of about 50,000 lbs, (about 25 tons) up to orbit and also be able to bring 25 tons back from orbit. It would also be capable of carrying a number of passengers.

This type of system, we feel, is going to revolutionise the way we move payloads back and forth to orbit. We hope it is going to reduce the cost to about the $50 per lb in orbit level, which, as I mentioned, is the objective. Some of our original plans indicate we may even be able to beat this cost figure. We feel that this will replace all of the existing rockets which we now have in production from the very small solid Scout rocket on the one hand up to the giant Saturn 5 rocket on the other. We feel that we probably will have need for a Saturn 5 size rocket which can put 250,000 lbs in earth orbit, and we probably want to have a small Scout and very small launchings, but in between we feel that all of the existing rockets that we have would be replaced by shuttle type operations.

Let me just say one word and this is a very speculative sort of comment but I want to indicate to you that as we look at the operations of the space shuttle we are examining the

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entire continental area of the United States to see what would be the best kind of launching area for a space shuttle. But the question of whether or not we should also have space shuttle operating bases overseas is very much on our minds and the question of (if we do have such overseas launch and recovery bases) where these should be, is something which we are looking at. The other question that we are considering is what sort of an international involvement should there be in this space shuttle, and if this indeed is going to be the launch and recovery standard system for the late 1970s it is certainly something which many nations may want to utilise and one of the principal points of my discussions with the Germans and the French, the English and the European Space Conference people has been this question of looking to the future and asking ourselves; What are the international co-operative and participative programme implications of this new space shuttle system?

Looking beyond the space shuttle itself, there is another parallel development programme which we feel is also coupled to the space shuttle and of great importance, and this is the so-called permanently orbiting space station. This is a place where men can live and work in orbit - a place which, instead of the present philosophy of putting something in orbit and having it fail after some years would remain permanently in earth orbit, a place where we would have the power supplies and the ability for men to live comfortably in a shirtsleeve environment and we would have the ability to add modules to this space station to carry out a large number of different activities from orbit which involve men - such things as looking outward to the stars and the planets with telescopes, both optical and radio, looking down to the earth for earth resource, oceanography and other types of investigations, studying the world's weather, by men looking down on it from orbit. We would have the ability to carry out fundamental investigations in such fields as biology - or I might mention high energy physics because it is possible to observe particles in orbit which are far beyond the energies which we can attain with the largest accelerators down here on the surface of the earth.

There are many different activities which a space station would make it possible to carry out. One of the fundamentals of such a space station however is the ability to travel back and forth from the surface of the earth to the space station many times at low cost, and the ability to take supplies and equipment and expendables back and forth to the space station. Of course this is where the space shuttle comes in. These are complementary systems. There is no question in my mind that the ability to add over the years a module here and a module there to the space station will in time allow us to build a very substantial facility in earth orbit, because once we have gone to the expense of raising a base station module into position, and bolting it onto the space station modules which are already there, we will be able very economically to add to this facility over the years.

Again the question of the degree to which this should be an international programme, the contributions which different nations might be interested in making to this kind of research laboratory in space is, I think, reminiscent perhaps of some of the arrangements we have made for exploration of the Antarctica, where various nations have taken on various stations and co-operate with one another. I think they have perhaps evolved an exploration pattern which is a sort of model of international co-operation. We would like to do a similar thing as we examine this new part of nature which exists a couple of hundred miles above all the continents and oceans of the world.

Finally I would just like to say a word about the question of what are the institutional implications? How can some of these things which I have described to you this morning best be utilised by all of mankind to get some of these practical benefits and also to participate in some of the science and some of the exploration? We do not wish to make any specific proposals whatsoever at this time for the kind of institutional patterns which may emerge. It is our view that the steps which should be taken are first of all to make available to you this document which describes the space programme which we propose to carry out for the 70s and with some implication to the 80s; to make this available to you and if anybody in the room does not have a copy of our prospectus we would be very happy to make them available to you. What we would like to do is to say the first step should be taken by the United States. This is to make available to you the results of our planning and this step has essentially been taken with this document and with my visit here to answer the questions which you may have this afternoon.

The things we would like you to consider are your own national interests, your own desires to take part of these programmes which constitute opportunities on which you would like to work with us, the degree to which you would like to work, and also the degree to which these would be neutral programmes involving other nations.

I was very pleased to receive an acceptance from Senator Anderson to the invitation which was issued to Australia to send observers to examine with us our space stations, and space shuttle requirements programmes as we evolve these; to get in at the very outset so that you will have a full understanding of how these programmes are shaping up and what is involved; so that you can make your own independent technological assessment of the chances of success of the programme, and also to put you in a position to answer the question as to whether you want to participate in any way in these. We also received acceptances to this meeting from Germany, France, from England, Italy, from Brazil.

I might add that in connection with our earth resources programmes we do have agreements with Brazil, Mexico, we have also flown over Iceland, over the Argentine with our earth resource aircraft, and the international participation in this programme is shaping up in a way which we feel is very promising. In examining your own interests in these very many fields which I have discussed - with communications, navigation, and earth resource and all of these things - what we will eventually have to work out is how all of the various nations who are interested can best work together to move these programmes ahead in a sensible way to get benefits for all our various peoples.

I think perhaps that is enough of my monologue on the subject, for the real purpose of my visit to Canberra has been rather to enter into a dialogue and to make ourselves available for any questions which you may have. Perhaps also to have some very preliminary discussions as to what is in our proposed programme for the 1970s and to put you in a position so you can begin to think about what we might discuss later about the mutual participation. The Canadian government is also quite interested in the proposals which we have made to them. One of the questions which we will, very frankly, have to face up to one day, even though we are not prepared to make any comments on it today, is whether or not the participation of the various nations in the space programme of the future should be on the basis of collateral agreements betwden the United States and the particular nation, or whether there should be more agreement which utilises some of the existing operations like ESRO and ELDO in Europe, to which perhaps could be added the participation of Japan, Australia, Canada, or whether some sort of a mixture. We have to consider what sort of role should be played by organisations like the United Nations, which has its Outer Space Committee. These are all questions which I think deserve the most thoughtful consideration.

It is in a very real sense, I think, that we have an opportunity in the exploration and utilisation of space to move ahead in an area where we do not have the traditional drawbacks that require so much negotiating because of the entrenched power positions of the past. In space we have a fresh new field - a field which gives us the opportunity perhaps to think in long range terms - a field, I think, which puts quite a responsibility on those of us who are at the present time responsible for this new field. It puts quite a responsibility on us to try to evolve new and powerful co-operation mechanisms which perhaps can be a model for international co-operation in some of the other areas. We have already, in the space age, made a number of advances in the 1960s. Some of the things we have tried have been very successful, others, I think, have been less successful. If, as we move into the 1970s, we can review the lessons we have learned in international participation and co-operation in the 1960s and apply these in innovative new ways, I will certainly be serving the people of the good planet earth very well. We have a real responsibility here.

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That concludes the general description of our programme that I wanted to personally lay before you, to give you my own views on what some of the important features are and perhaps to serve as somewhat of a prologue to more intimate discussions of the particular things in our programme which you feel we should jointly explore as we move ahead to answer the question of what kind of international participation we should be now setting up for this brand new technology of space, which we will be bringing on to stream during the decade of the 1970s.